Decadal Changes in Cloud Geographical Distributions

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Outline

The latitudinal width of the tropics is expanding
Brief review of previous work

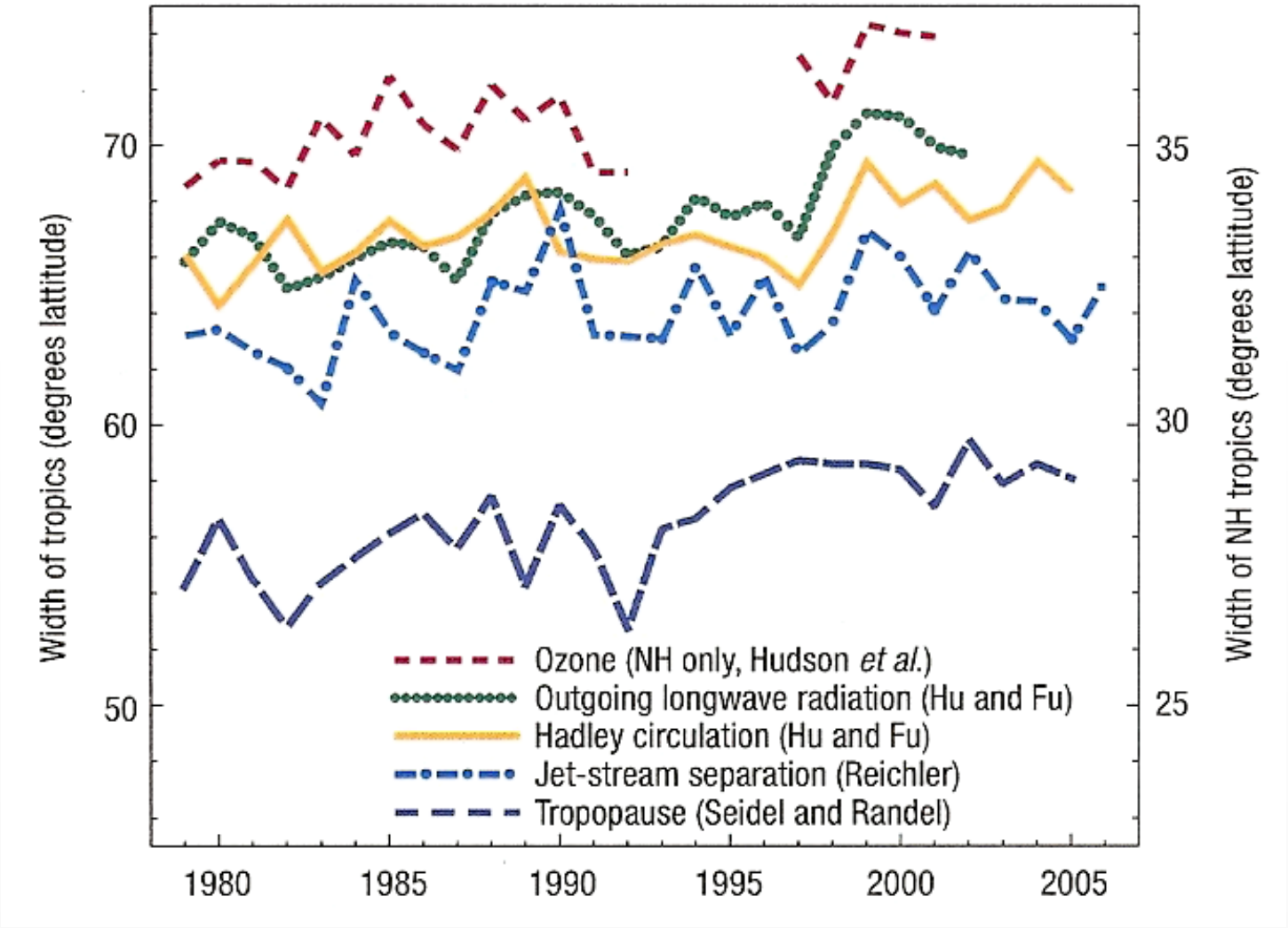
How are cloud geographical distributions changing?

Discuss the analyzed cloud data

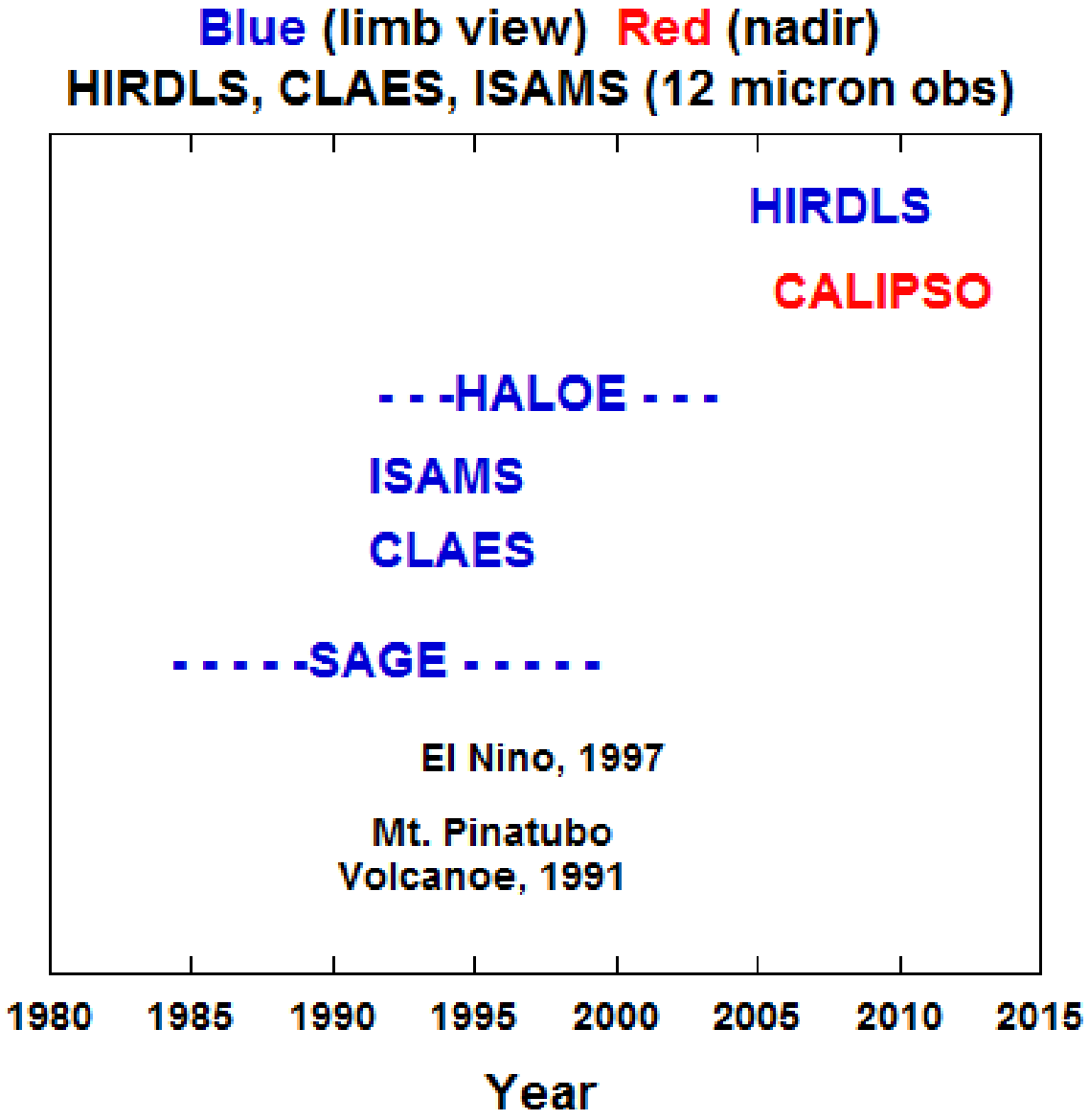
Discuss methodology

Present preliminary results

Expansion of the Tropics
2° / decade (both hemispheres)



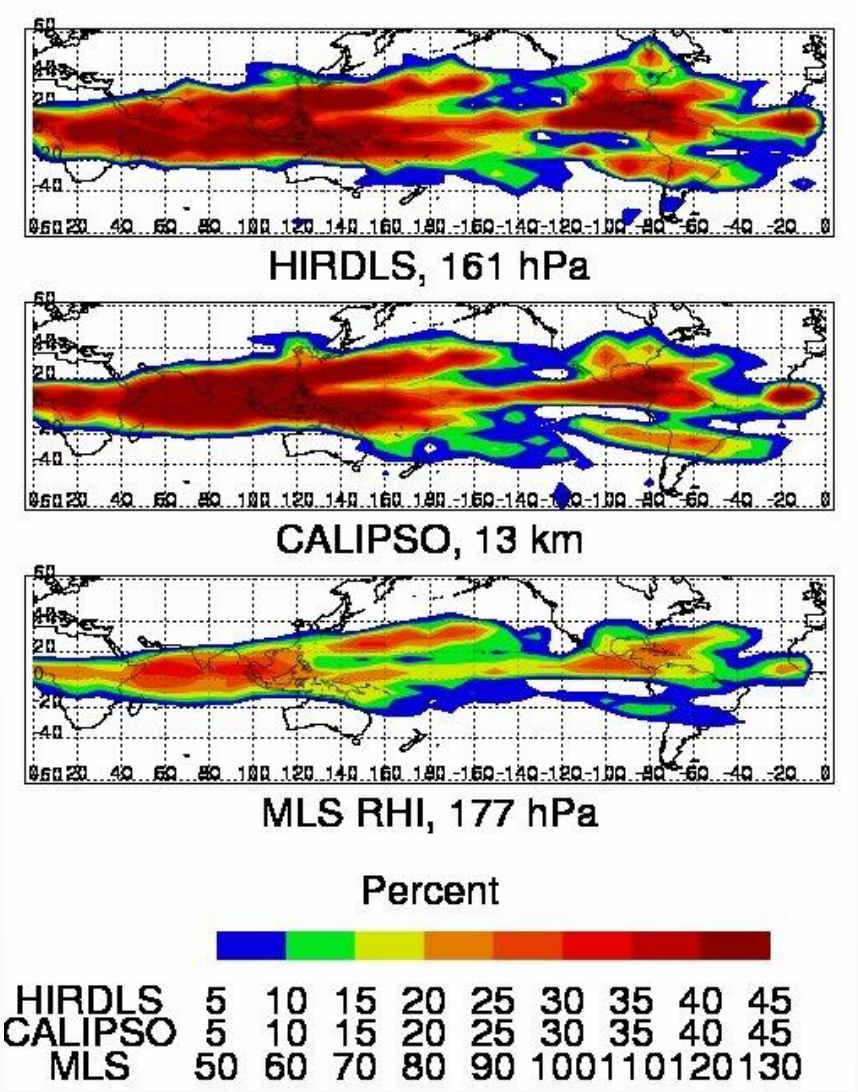
Seidel et al., Nature Geo Sci., v 1, p 21-24, 2008



2010 - 1985
= 25 years

2° x (25/10)
= 5°
Potential Change

What range of longitude to use to define the Width of the Tropics?

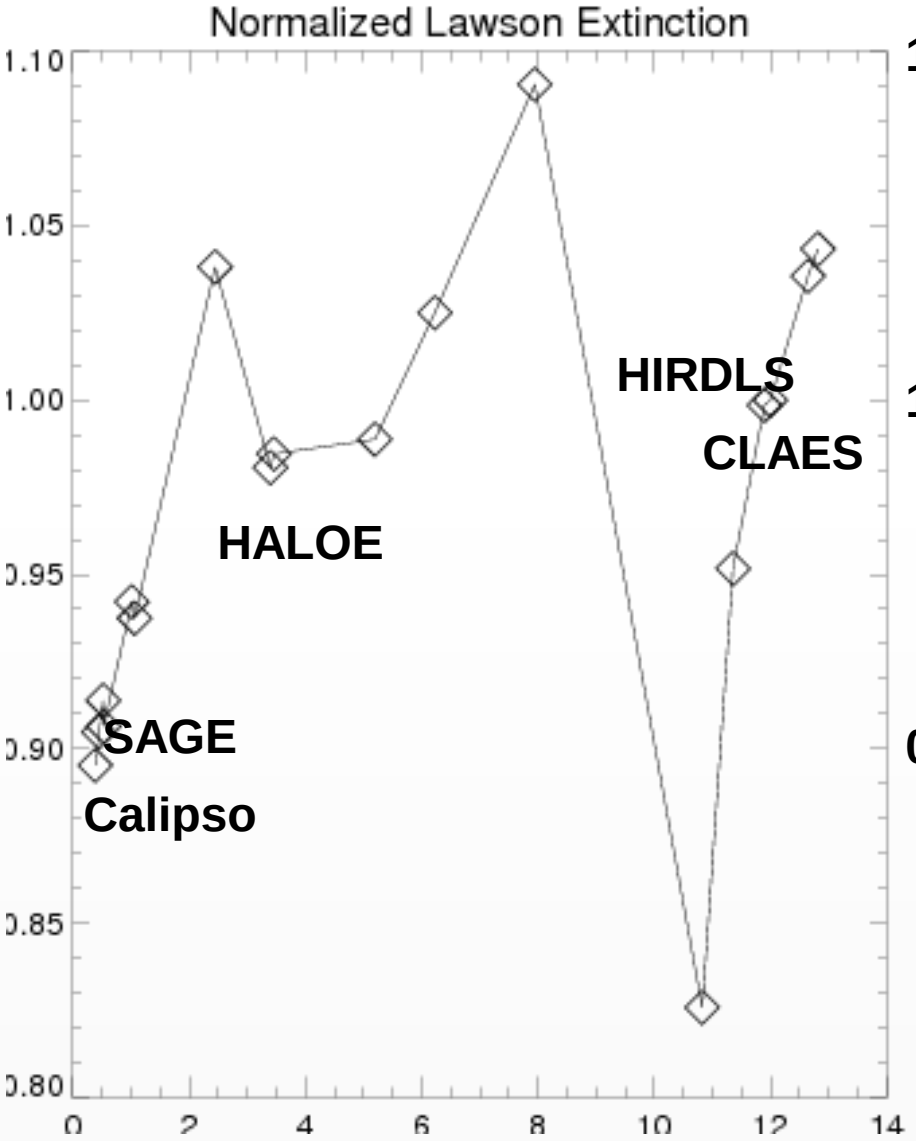


Monthly average

June 2007

Massie et al, JGR, 2010

Wavelength Dependence of Cirrus Extinction



Normalized Extinction

1.10

1.00

0.90

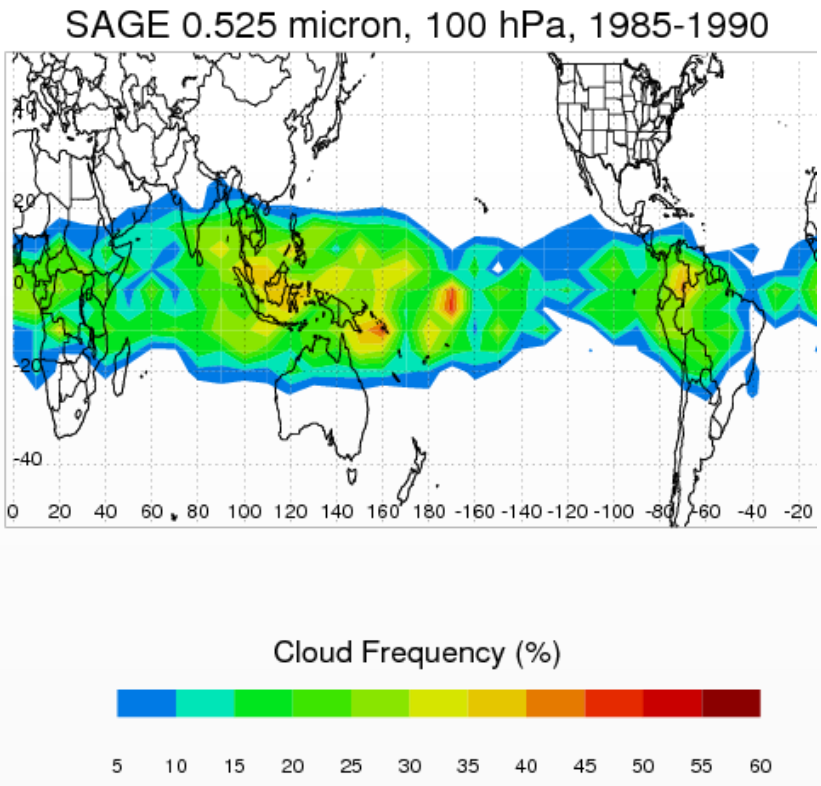
10 %

Input: Paul Lawson small cirrus size distribution

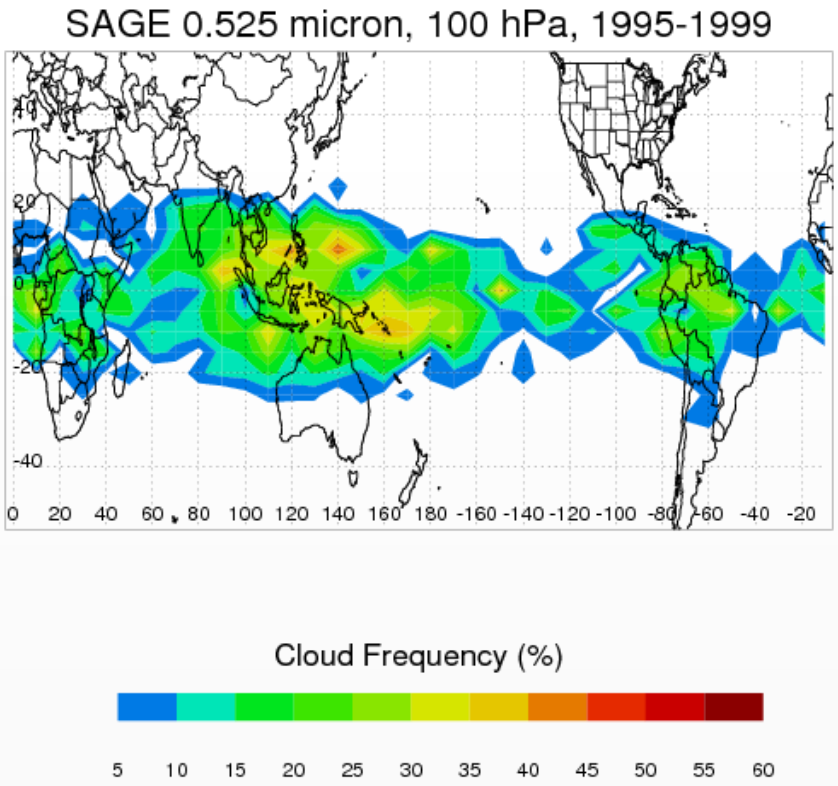
Wavelength (microns)

SAGE
Cirrus Frequency at 100 hPa

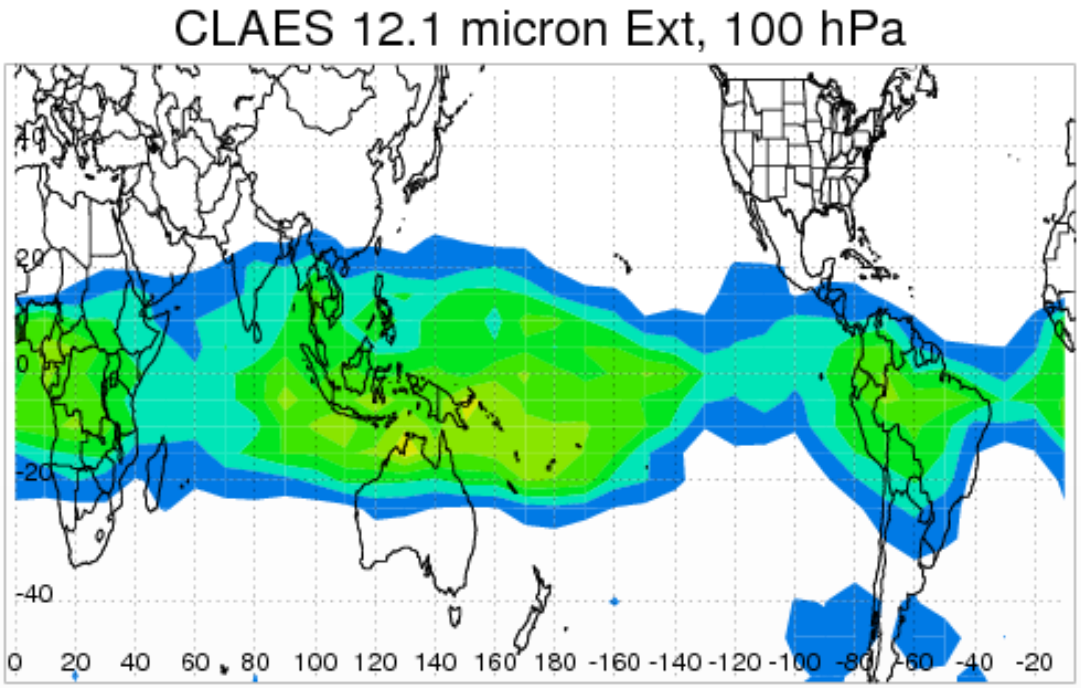
1985 – 1990



1995 - 1999

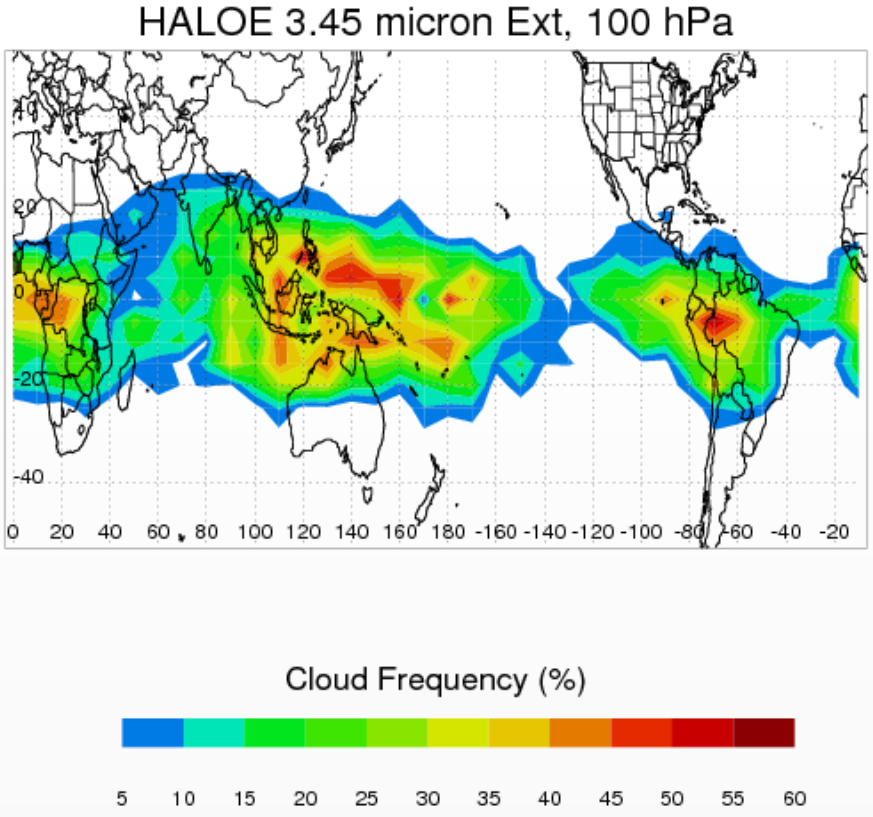


CLAES
May 1992 – May 1993, 100 hPa

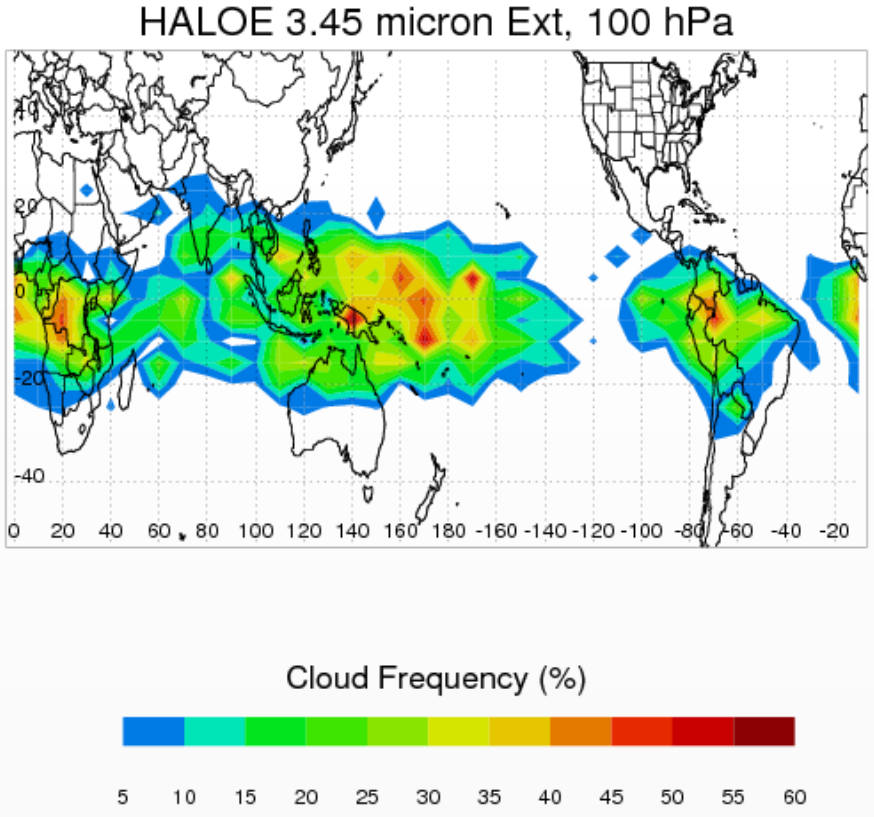


HALOE
Cirrus Frequency at 100 hPa

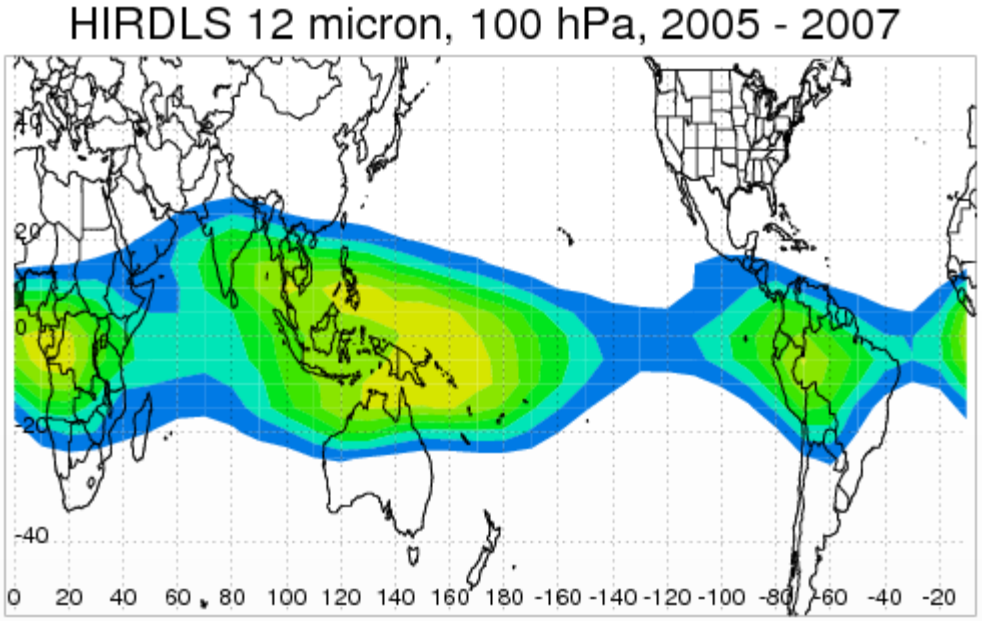
1994 - 2000



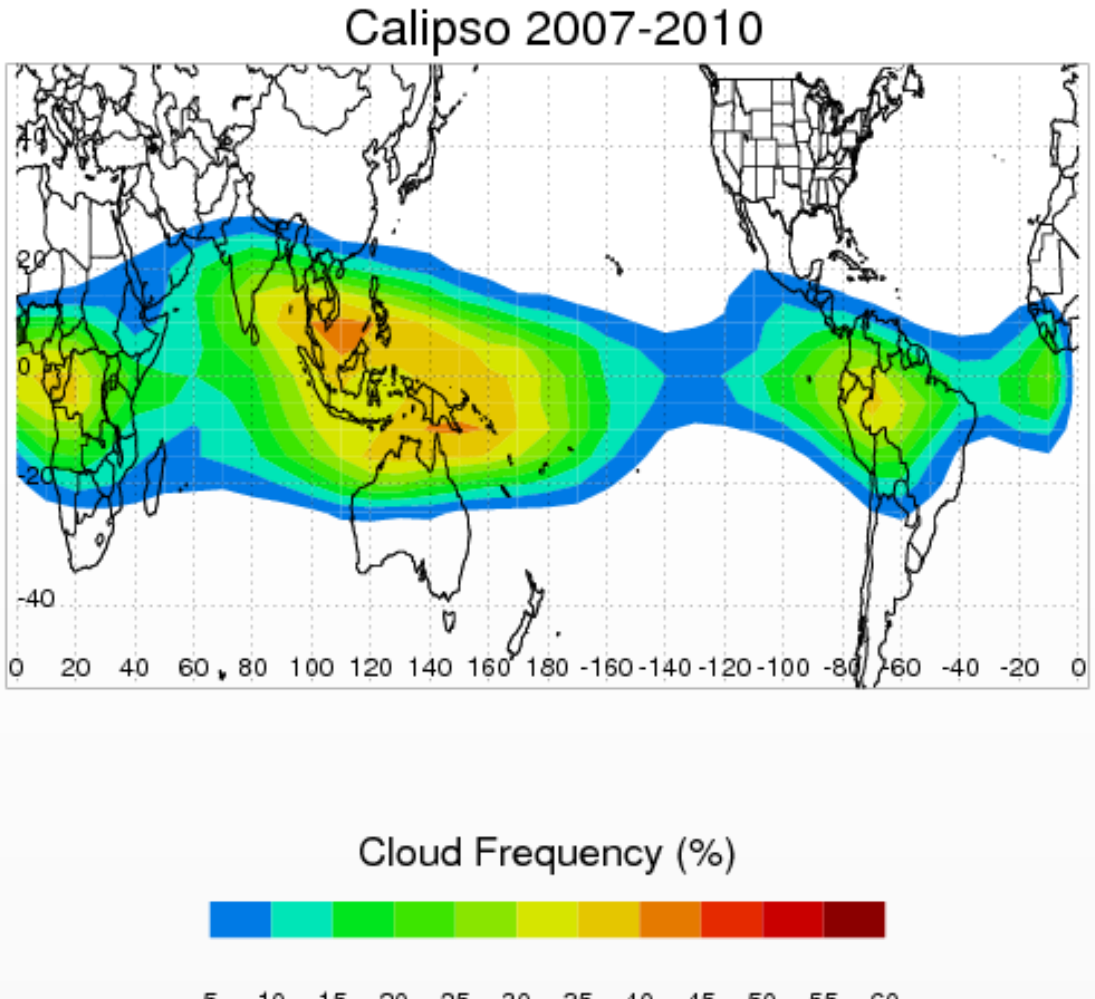
2001-2005



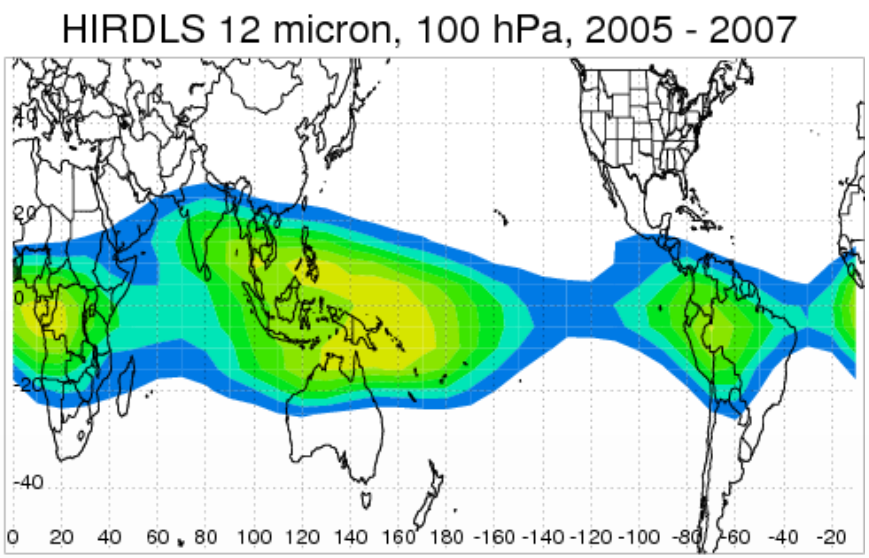
HIRDLS 2005-2007
Cirrus frequency at 100 hPa

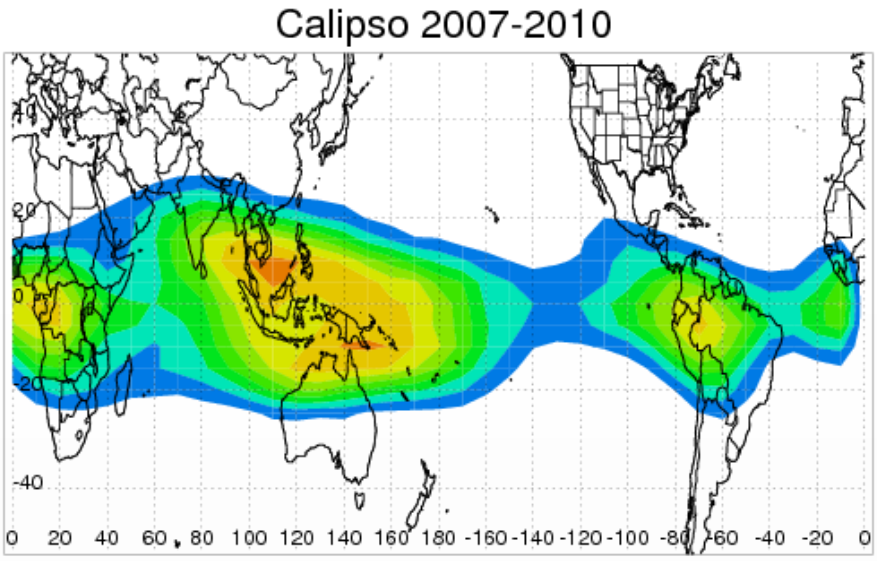


CALIPSO 2007-2010
Cirrus frequency at 16 km



HIRDLS 2005 – 2007 100 hPa
CALIPSO 2007-2010 16 km





Determine Width of the Tropics

Input

Latitude-Longitude cirrus frequency of occurrence at 100 hPa for each experiment

Calculate

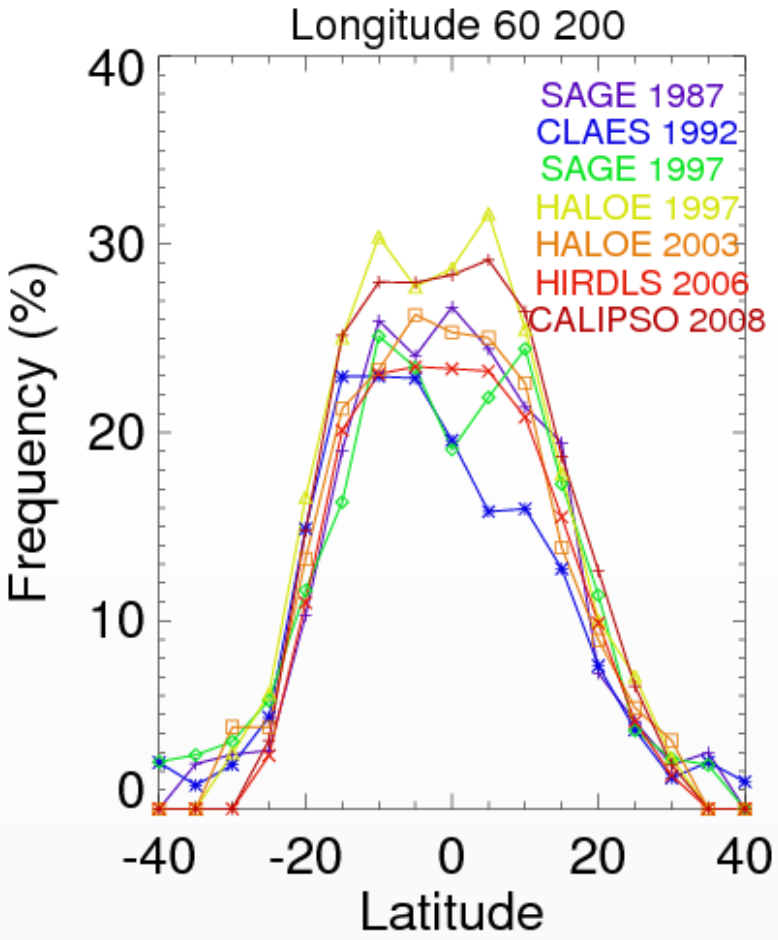
Curves of average frequencies in 5° latitude steps for longitude range e.g. 60 – 200 E

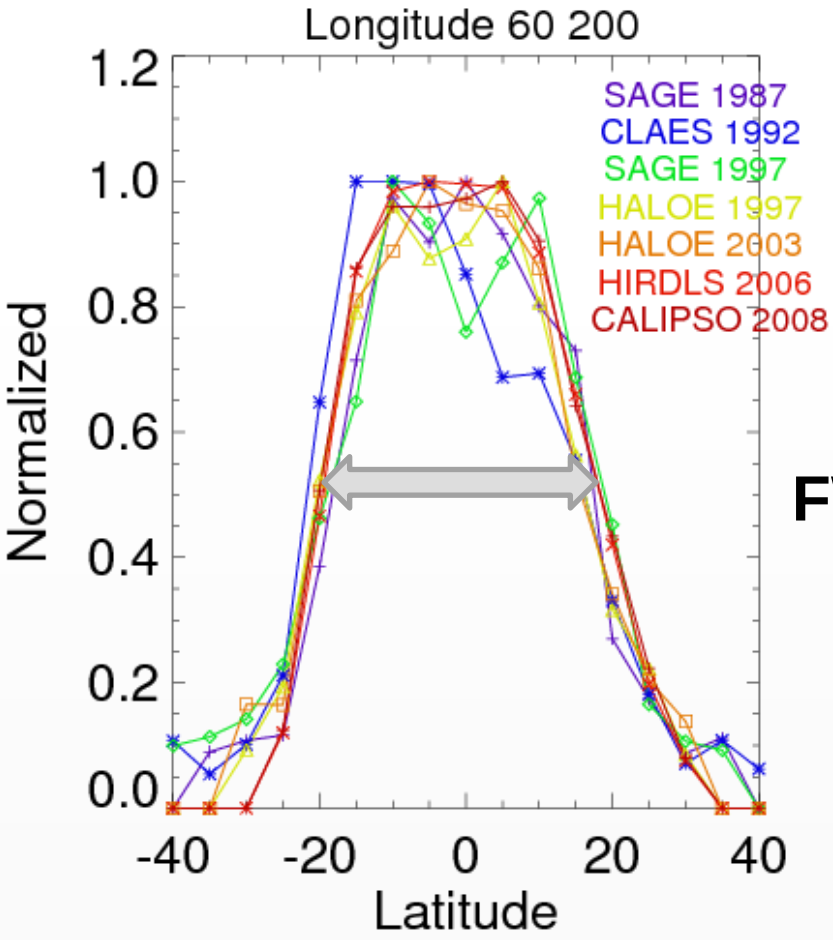
Normalize the curves to unity near the max frequency

Determine the FWHM of the normalized curves

Original Averages

Normalized

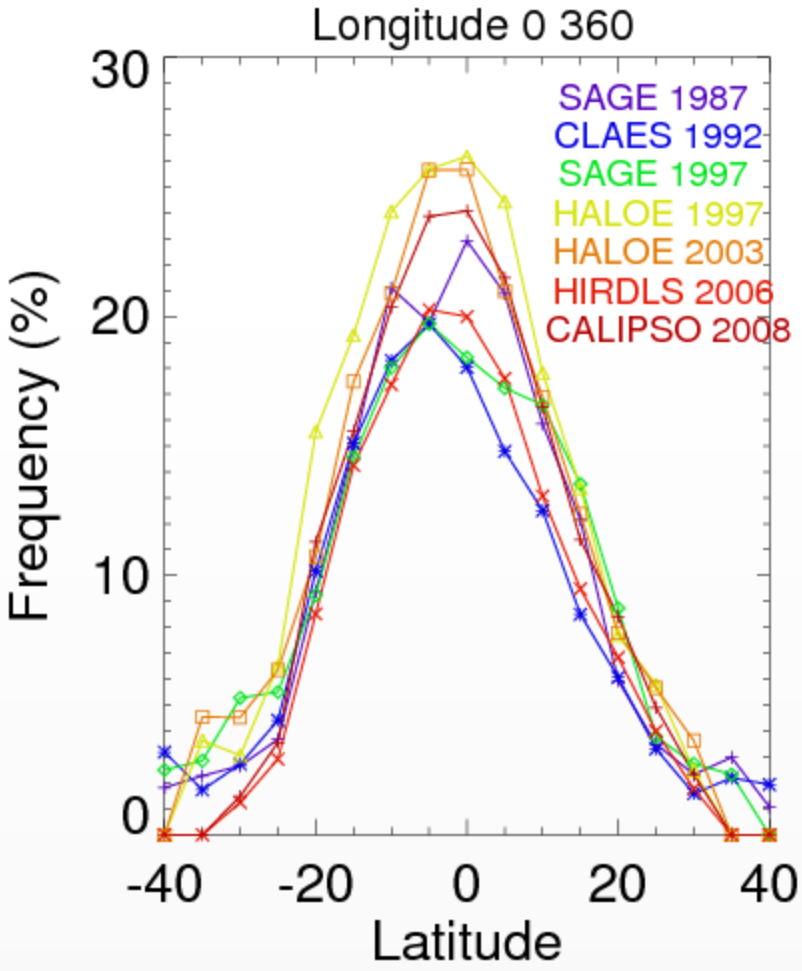




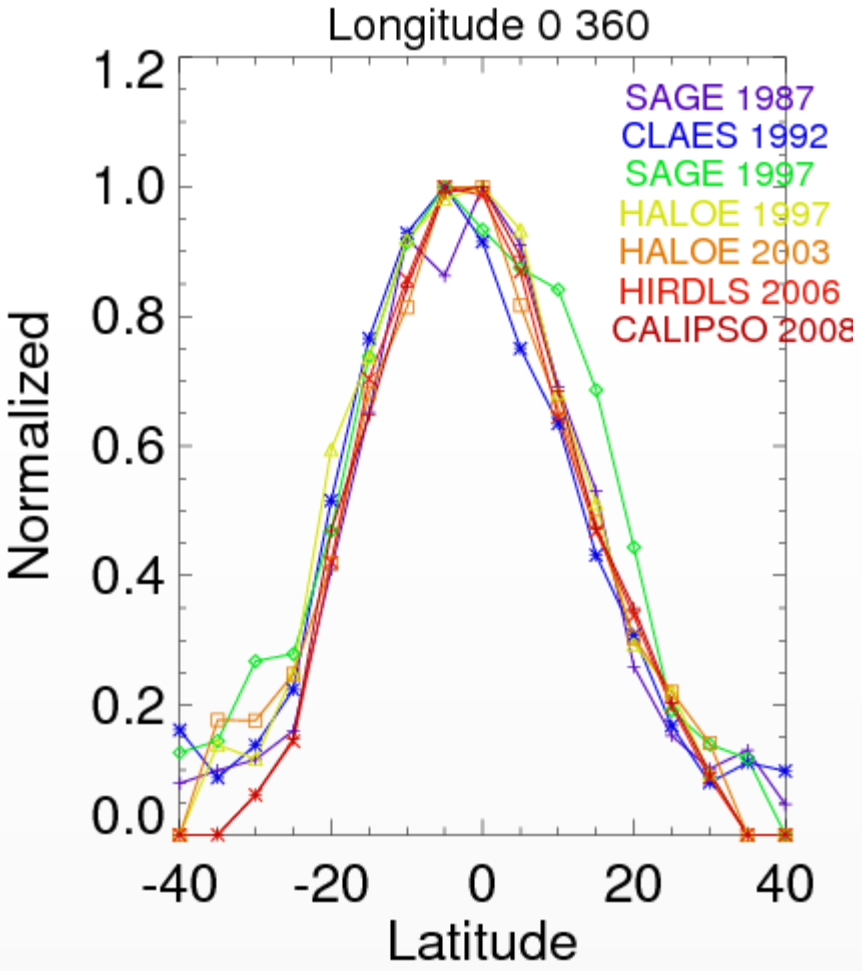
FWHM

60 – 200 Iindian Ocean, Indonesia, dateline

Original Averages



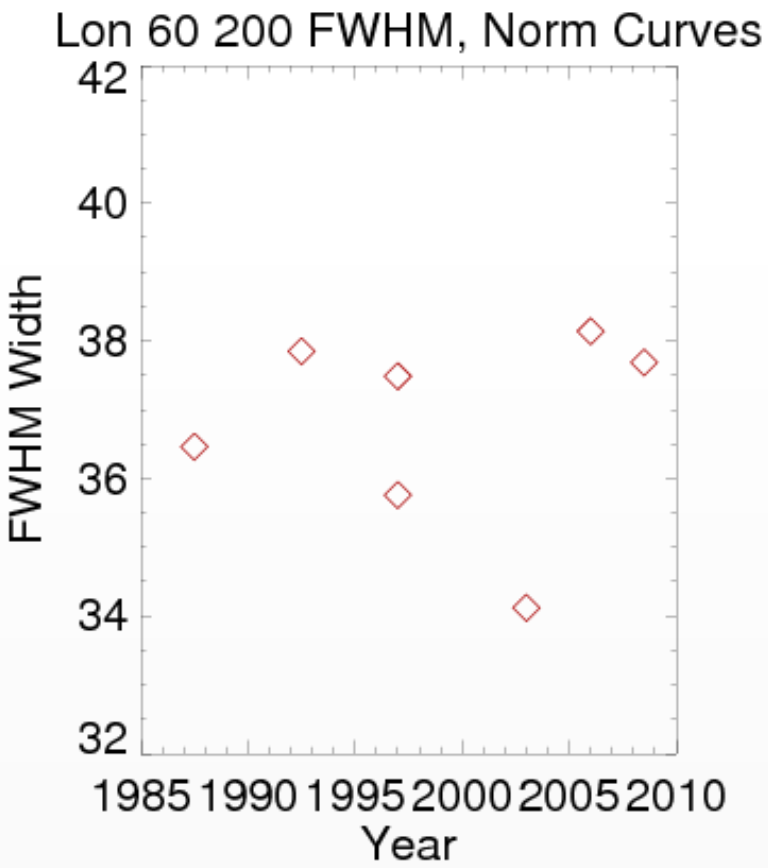
Normalized



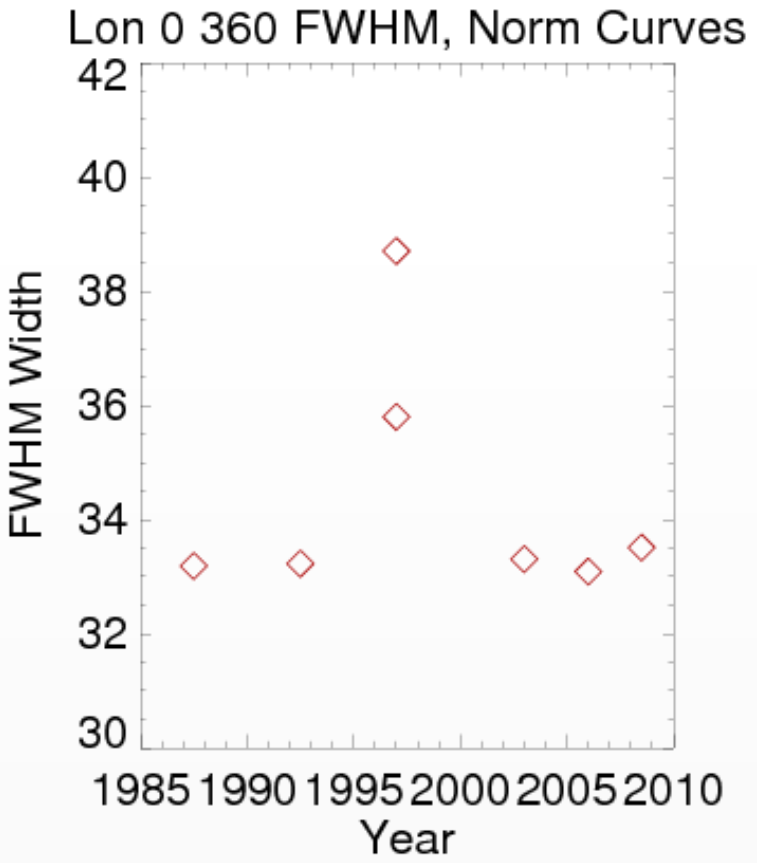
All longitudes

FWMH trends at 100 hPa

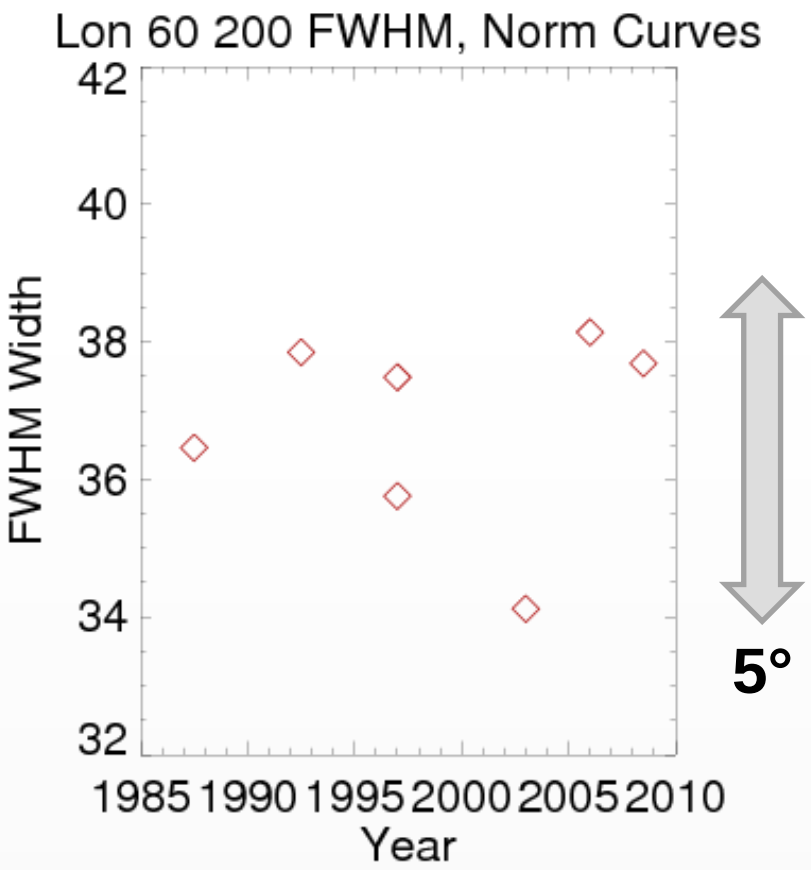
60 – 200



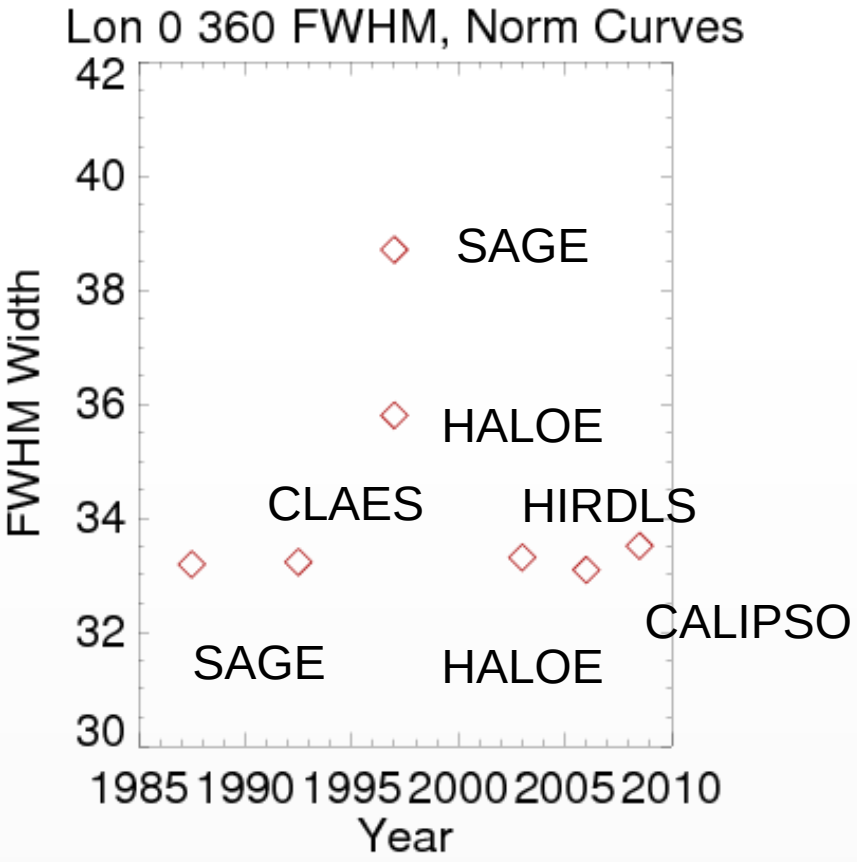
All longitudes



FWMH trends at 100 hPa



5°



Conclusions

Based upon data from 5 experiments, with data from 1985 to the present :

The data can be used effectively to quantify changes in cloud distributions during the last 25 years in the upper troposphere

The full width half max (FWHM) of cirrus frequency of occurrence changes at 100 hpa very little during the last 25 years.

Thank You

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To provide facility support to the wider community; and,
To apply the results to benefit society.

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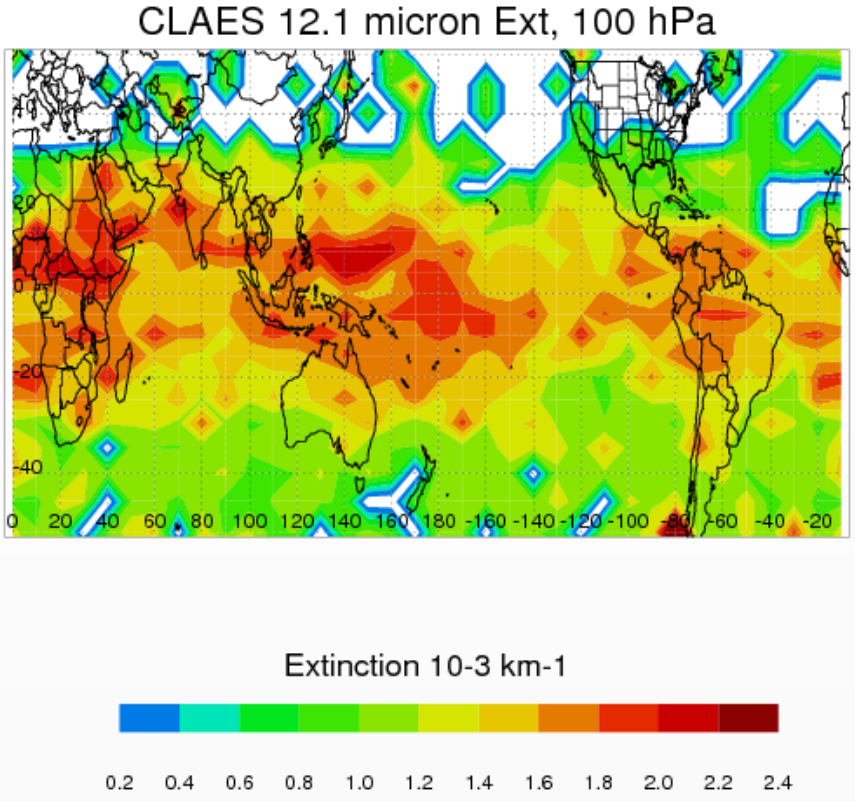
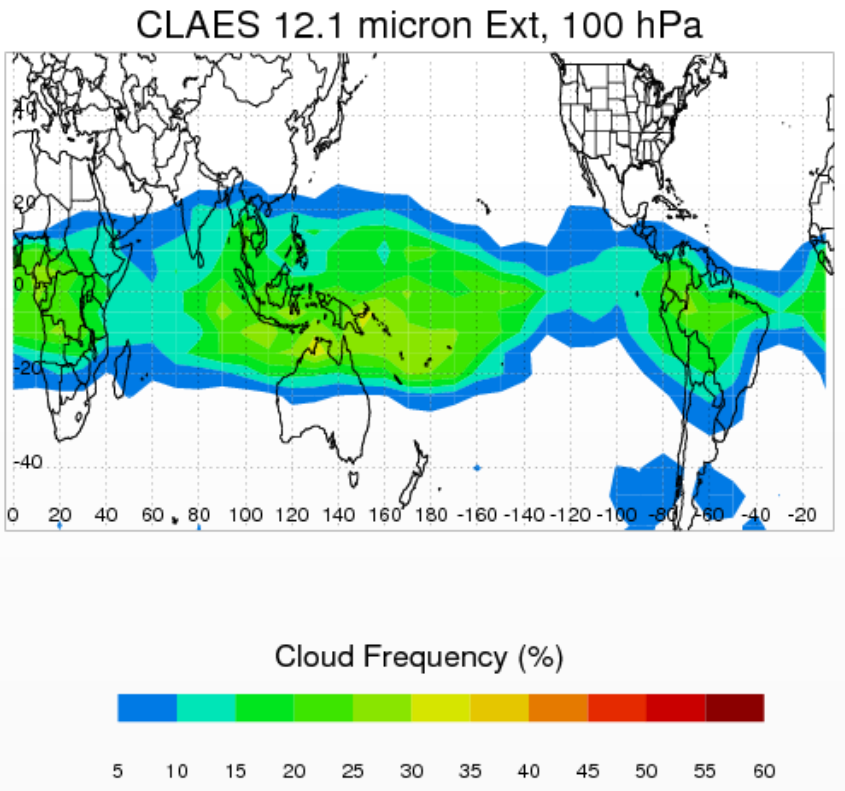
CLAES
May 1992 – May 1993, 100 hPa

Extinction



Frequency



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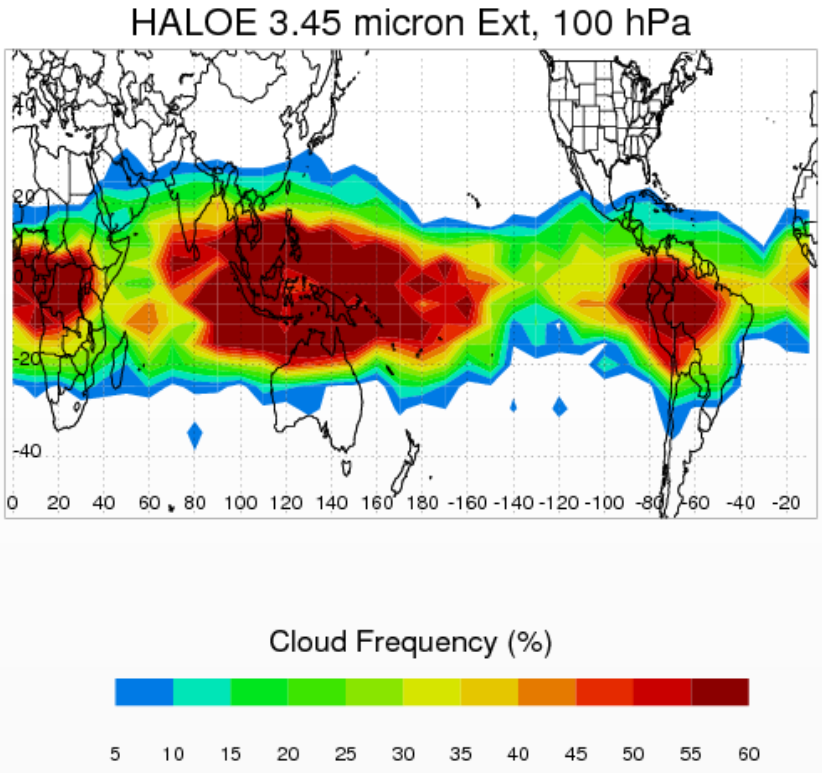

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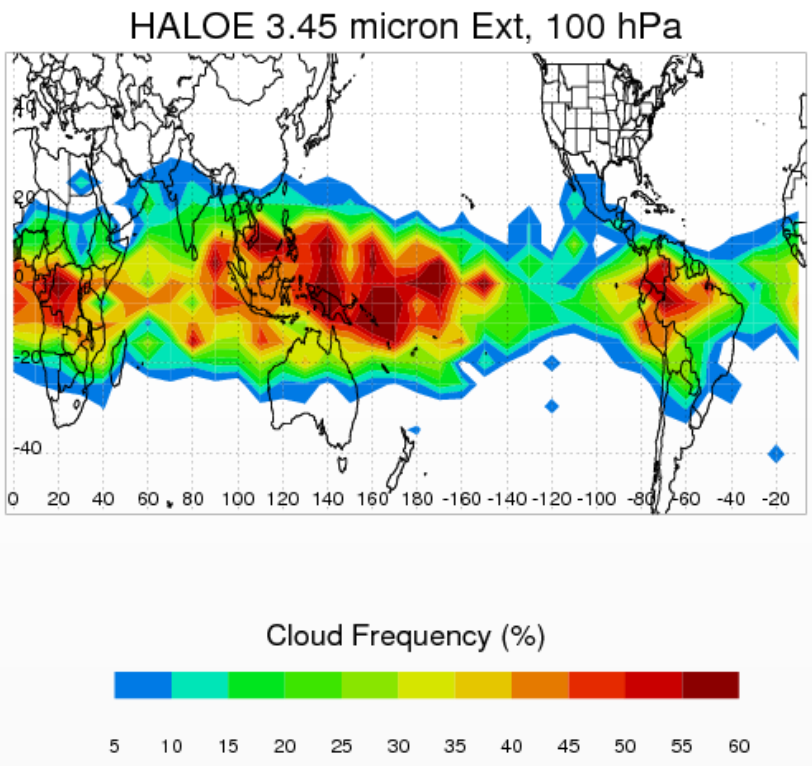
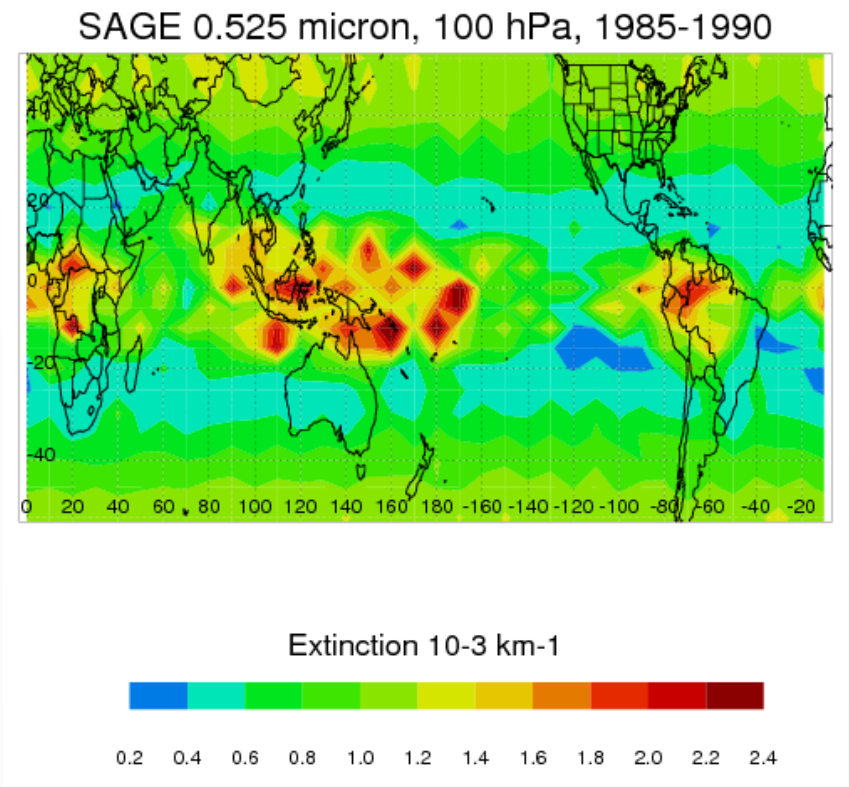


0.0 < psi < 0.1

SAGE
Extinction at 100 hPa

1985 – 1990



1995 - 1999